Assessment and management of severe acute malnutrition in children aged 6–59 months by professional nurses in primary healthcare facilities in the Johannesburg health district, South Africa: A retrospective analysis

by
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Thesis presented in partial fulfilment of the requirements for the degree Master of Nutrition in the Faculty of Medicine and Health Sciences at Stellenbosch University

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DECLARATION

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ABSTRACT

Introduction: Severe acute malnutrition (SAM) is a public health concern, due to the high mortality rates observed in children with this condition. The correct classification of children with SAM remains a challenge. Children with SAM usually present at primary healthcare (PHC) with other illness and will only be classified and managed for SAM through the correct measurement, plotting and interpretation of anthropometric data. Children identified with SAM should be referred to the hospital and admitted for further management to reduce case-fatality rates. The management of SAM at PHC and hospitals plays a unique role in child survival.

Aim: The aim of the study was to evaluate the assessment and the management of SAM in children aged 6–59 months by professional nurses in PHC facilities in the Johannesburg (JHB) health district.

Methods: This was an observational study with a cross-sectional, retrospective descriptive study design. Quantitative data collection methods were used to review clinic records of children in the JHB district.

Results: Records of 83 children were selected from 35 clinics. Only 81 (98%) of the children's weights were recorded, 27 (33%) had height and only 20 (24%) of children had mid-upper arm circumference (MUAC) measurements taken. Only 12 (14%) patients had a record of oedema, 58 (66%) patients had no oedema noted while in 16 (19%) patients there were no entries recorded for either the presence or absence of oedema. Nurses assessed 51 (61%) of children for feeding, of which 18 (35%) were still breastfeeding, 49 (96%) were receiving formula milk and 26 (51%) of the children were recorded as receiving solid food. Only 12 (14%) of the children were correctly identified with SAM.

Conclusion: The study concludes that the overall assessment, classification and management for children with SAM in JHB district clinics was poor and often did not adhere to the Integrated Management of Childhood Illnesses (IMCI) guidelines. The practices of professional nurses in this district point to poor recognition of the need for accurate assessment and monitoring in order to reduce the risk of death in children with SAM.

OPSOMMING

Inleiding: Ernstige akute wanvoeding (EAW) is ’n openbare gesondheidskwessie, as gevolg van die hoë sterftesyfer onder kinders met hierdie toestand. Die korrekte klassifisering van kinders met EAW bly ’n uitdaging. Kinders met EAW meld gewoonlik met ’n ander siekte by primêre gesondheidsorg- (PGS-) klinieke aan en sal slegs op grond van die korrekte meting, aantekening en interpretasie van antropometriese data as gevalle van EAW geklassifiseer en hanteer word. Kinders wat met EAW geïdentifiseer is, moet na die hospitaal verwys word en vir verdere hantering opgeneem word om die sterftesyfer te beperk. Die hantering van EAW by primêre gesondheidsorg klinieke en hospitale speel ’n unieke rol in kinders se oorlewing.

Doel: Die doel van die studie was om die evaluering en hantering van EAW in kinders van 6–59 maande deur professionele verpleegkundiges in PGS-klinieke in die Johannesburg-gesondheidsdistrik te evalueer.

Metode: Dit was ’n waarnemingstudie met ’n retrospektiewe, beskrywende deursnee-navorsingsontwerp. Kwantitatiewe dataversamelingsmetodes is gebruik om die kliniekrekords van kinders in die Johannesburg-distrik te ondersoek.

Resultate: Rekords van 83 kinders van 35 klinieke is gekies. Een-en-tagtig (98%) van die kinders se gewig was aangeteken, 27 (33%) se lengte en 20 (24%) se boarm-omtrek (MUAC). Slegs 12 pasiënte (14%) het ’n rekord van edeem gehad, 58 pasiënte (66%) het geen aantekening oor edeem gehad nie en vir 16 pasiënte (19%) was daar geen inskrywings oor die aan- of afwesigheid van edeem nie. Verpleegkundiges het 51 kinders (61%) se voeding geassesseer; 18 (35%) van hulle is geborsvoed, 49 (96%) het formulemelk ontvang en 26 (51%) van hulle is aangeteken dat hulle op vaste kos was. Slegs 12 (14%) van die kinders is korrek met EAW geïdentifiseer.

Gevolgtrekking: Die studie het bevind dat die algemene evaluering, klassifisering en hantering van kinders met EAW in Johannesburgse distriksklinieke swak was en dikwels nie die riglyne vir die Geïntegreerde Bestuur van Kindersiekte (IMCI) gevolg het nie. Die praktyke van professionele verpleegkundiges in hierdie distrik wys op ’n swak begrip van die behoefte aan akkurate evaluering en monitering ten einde die sterfterisiko in kinders met EAW te verminder.

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Contributions by principal researcher and fellow researchers

The principal researcher, Simon Vally Shabangu, developed the research topic, the idea and the protocol. The principal researcher planned the study, undertook data collection, captured the data for analysis, analysed the data with the assistance of the statistician, interpreted the data and drafted the thesis. Prof LM du Plessis and Ms C de Lange provided guidance at all stages and reviewed the protocol and thesis.

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LIST OF ABBREVIATIONS

CHC	Community Health Centre
Child PIP	Child Healthcare Problem Identification Programme
DHIS	District Health Information System
GMP	Growth monitoring and promotion
HIV	Human immunodeficiency virus
IMCI	Integrated Management of Childhood Illness
JHB	Johannesburg
LBW	Low birth weight
MAM	Moderate acute malnutrition
MDG	Millennium Development Goals
MUAC	Mid-upper arm circumference
NDOH	National Department of Health
ORS	Oral Rehydration Solution
PHC	Primary Healthcare
RTHB	Road to Health Booklet
RUTF	Ready-to-use therapeutic food
SAM	Severe acute malnutrition
SD	Standard deviation
SDG	Sustainable Development Goals
TSF	Targeted supplementary feeding
TB	Tuberculosis
UNICEF	United Nations Children's Fund
URI	Upper respiratory infections
WB	World Bank
WHO	World Health Organization
WHA	World Health Assembly
WHZ	Weight-for-height z-score

LIST OF DEFINED TERMS

Anthropometric measurements: When height, length, weight, arm circumference, skinfold thickness or other body measurements are taken on any human being they are called anthropometric measurements. Such measurements are often expressed in ratios of one to another, e.g. weight-for-height. These measurements, when compared to national or international norms for healthy groups of people for that particular age and sex, are referred to as assessment of nutritional status.[1]

Evaluation: A process of data collection designed to assess the effectiveness of the project in attaining its original objectives and the extent to which observed changes are attributable to the project.[2]

Growth monitoring and promotion: The regular measurement, recording and interpretation of a child's growth in order to counsel, act and follow-up results with the purpose of promoting child health, human development and quality of life.[1]

Malnutrition: Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients. It includes over-nutrition, which is an excess of one or more nutrients, usually of energy, and under-nutrition, which refers to a deficiency of energy and / or one or more essential nutrients[3]**.**

Moderate acute malnutrition: Moderate acute malnutrition (MAM) is defined as a weight-for-height between -3 and -2 z-scores below the median of the World Health Organization (WHO) child growth standards, or mid-upper arm circumference (MUAC) between 11.5 and 12.4 cm.[1,3,4]

Monitoring: The collection and review of information on project implementation, coverage and utilisation of inputs.[5]

Nutritional status: The nutritional status of a person as determined by anthropometric measures (height, weight, circumference etc.), biochemical measures of nutrients, or their by-products in blood and urine, a physical (clinical) examination and a dietary assessment and analysis.[3]

Primary health care (PHC): Primary Health Care is essential health care based on practical, scientifically sound and socially acceptable methods and technology, made universally accessible to individuals and families in the community through their full

participation and at a cost that the community and the country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination[6].

Oedema (nutritional): Bilateral symmetrical pitting oedema (fluid retention on both sides of the body), caused by increased fluid retention in extracellular spaces, is a clinical sign of severe acute malnutrition (SAM). There are different clinical grades of oedema: mild, moderate and severe.[4]

Ready-to-use therapeutic food (RUTF): An energy-dense, micronutrient paste, based on a mixture of peanuts (or alternatives such as chickpeas, lentils or rice), sugar, oil and milk powder, suitable for children aged 6–24 months.[4.7]

SAM is defined as anyone of the following: weight-for-height or length below -3 standard deviations (SD)/z-score <-3. Mid upper arm circumference of less than 11,5 in children aged 6-60 months. The presence of bilateral pitting pedal oedema.[3,4,8]

SAM facility case fatality rate for children under five years (DHIS): The proportion of children under five years admitted and died due to SAM. This is an inpatient care facility performance indicator.[4]

SAM incident rate in children under five (DHIS): The number of new cases of severely acutely malnourished children detected per 1 000 population of children under five. This measure is more accurately referred to as new case detection rates.[4]

SAM without medical complications: These are SAM children who do not have medical complications, have an appetite (pass the RUTF appetite test) and are clinically well and alert. They should be treated as an outpatient for uncomplicated SAM.[4,8]

Targeted supplementary feeding (TSF): A type of intervention that usually provides nutritional supplements to a selected group of children, pregnant and lactating women and other nutritionally vulnerable groups.[1]

Under-nutrition: Too little food or nutrients in the diet resulting in immediate and / or long-term adverse consequences on health status and / or physical and mental development [3].

CHAPTER 1: INTRODUCTION

1.1 Introduction

Severe acute malnutrition (SAM) is a public health concern, due to the high mortality rates observed in children with this condition. Globally, about 25 to 35 million children under the age of five are diagnosed with SAM and 13 million of these children live in sub-Saharan Africa. Of these, one million will die every year. In South Africa, there may possibly be an underestimation of the impact of malnutrition on mortality and morbidity due to failure in identifying malnutrition as the reason for admission to hospital or death. Out of all South Africa's under-five deaths audited between 2012 and 2013, 30% were associated with SAM, 29% with underweight-for-age, 1% with overweight-for-age, 34% with normal nutritional status and 6% with unknown reasons.[9]

Severe acute malnutrition is identified at primary health care (PHC) level by using the Integrated Management of Childhood Illness (IMCI) guideline. Children with SAM have a higher risk of death, estimated at 5 to 20 times above that of children with normal nutritional status, since the condition's complications, i.e. hypoglycaemia, hypothermia, infections and dehydration, can be life-threatening within 48 hours if a child is not stabilised.[10] Therefore, prevention and management of these complications at PHC level are important, before the child is referred to the hospital. Correct classification and management at PHC level are therefore crucial to prevent these deaths in hospital.[11]

Global regional child malnutrition evaluations by the United Nation Children's Fund (UNICEF), World Health Organization (WHO) and World Bank (WB) from 1990 to 2017 reveal that the world is still far from eradicating malnutrition. It also reveals inadequate progress to reach the World Health Assembly (WHA) targets set for 2025 and Sustainable Development Goal (SDG) nutrition indicators set for 2030.[12]

The prevalence of SAM is an indicator for monitoring SDG 2, which refers to ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture. Severe acute malnutrition also has an impact on SDG 3, which refers to ensuring a healthy life and promoting well-being for all at all ages, because it affects the intellectual abilities and the future education of the child.[13]

The National Department of Health (NDOH) of South Africa has highlighted that management and referral processes of children with SAM should be optimal to ensure the reduction of deaths (case fatality rates) within healthcare services.[10] Professional nurses are the key providers of child healthcare at PHC level, as indicated for the District Health System. Professional nurses are therefore best positioned to give complete care, including nutritional assessment, counselling and support to children with SAM and their caregivers.

SAM is the most life-threatening and visible form of undernutrition. Acute malnutrition is known to contribute significantly to child mortality and mobility, with one-third of reviewed child deaths being related to SAM. The report *Saving children 2012–2013* has reported that almost 43,8% of children who died were not referred to the hospital where they died. The contribution of SAM was most notable in children under five years old, as 42% of children in this age group that died had SAM.[9]

1.2 The rationale for the research study

The care of children younger than five years at PHC level is directed by the IMCI guidelines. The IMCI case management process recommends that nutritional assessment, classification of any problem, appropriate management and the scheduled monitoring of planned interventions should be done whenever a child attends the clinic.[14] Childhood illness that are covered in IMCI include cough or difficult breathing, diarrhoea, fever, measles, ear problems, sore throat, malnutrition**,** anaemia, HIV and TB [8]. If the child presents with one of the mentioned illnesses, then the professional nurses should check for malnutrition.

The aim of this study was to evaluate the assessment, classification and management of SAM at PHC level by professional nurses before referral to hospital in the JHB district. Furthermore, PHC is aimed at prevention of SAM in children under five years. The JHB district has been implementing growth monitoring and promotion (GMP), targeted supplementary feeding (TSF) and IMCI to curb the incidence of SAM. According to the JHB District Health Information System (DHIS), the incidence of SAM in the JHB district for the period April 2015 to March 2016 was 788 cases. However, only 281 children were admitted to the hospital for treatment of SAM.[15]

The incidence of SAM in the JHB district (Figure 1.1) shows that the majority of children who were classified as having SAM were not admitted to hospital for SAM. It could be that the children were not SAM cases and were recorded as SAM or had moderate acute malnutrition (MAM) and were not referred to hospital for management.

Correct identification of children with SAM is particularly challenging. Furthermore, a child with SAM will usually present at PHC facilities with other health conditions and will only be identified through correct measurements and plotting of weight and height/length. An increase in incidence, therefore, may reflect more active case-seeking and recognition, rather than a true increase in the incidence of SAM.[16]

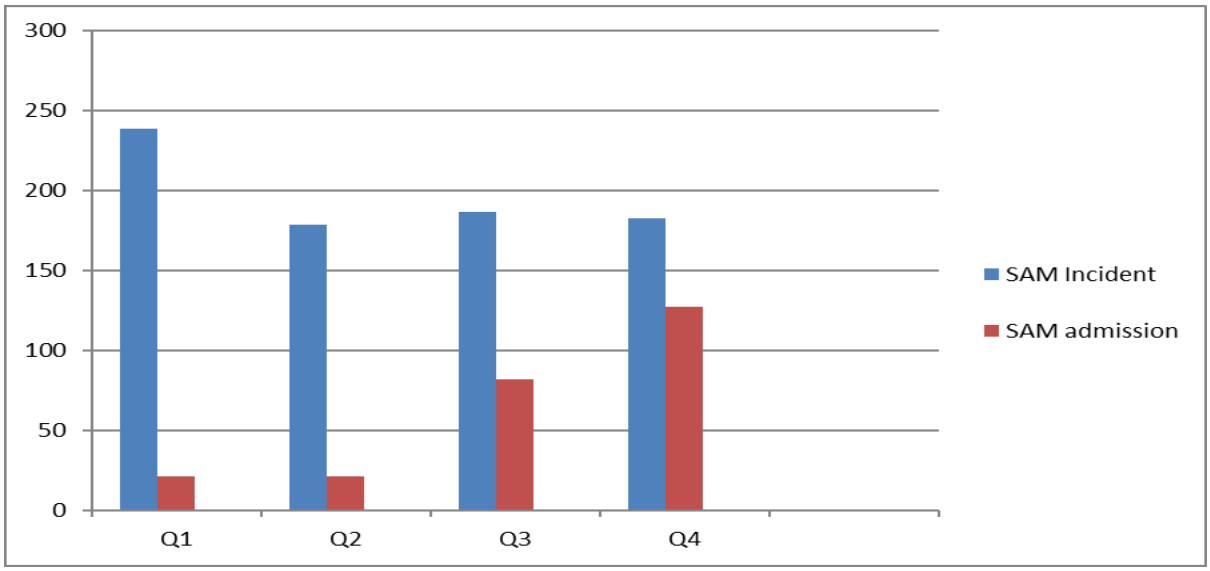

Figure 1.1: Incidence of SAM against SAM admissions in the JHB district for the period April 2015 to March 2016[15]

The situation described here led the researcher to explore the following question: How are children who are ill and attending PHC facilities in the JHB health district assessed and managed for SAM?

1.3 Structure of the thesis

The thesis consists of a short introduction to the study given in Chapter 1. The literature review follows in Chapter 2, while Chapter 3 is devoted to the description of the research design and methodologies. The results of the study are presented in Chapter 4, while Chapter 5 is devoted to the discussion of the findings. The

conclusions and recommendations from the research study are presented in Chapter 6.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The aim of the literature review is to provide a broad-based perspective on SAM. Furthermore, the literature review will highlight the significance of monitoring and evaluation of the effectiveness of the IMCI nutrition component and the importance of addressing any weaknesses detected through monitoring of the IMCI strategy. The importance of sharing knowledge or resource distribution for greater impact in addressing SAM will be detailed.

The effect of SAM on children under five has resulted in an extensive body of literature worldwide. Databases explored on this topic included PubMed, Google Scholar, Cochrane Library and Medline. The search focused on the following keywords: “wasted”, “IMCI malnutrition component” and “severe acute malnutrition”. The literature search was restricted to studies at PHC level or outpatient-based management of SAM using IMCI in developing countries because resources and clinical practice settings are likely to be similar to those found in PHC in South Africa.

The review outlines the impact of SAM on the morbidity and mortality of children in the developing world. The IMCI strategy’s nutrition component is introduced and studies that emphasise how the IMCI guidelines improved clinical outcomes are included. Also included are the features that promote successful implementation of the IMCI guidelines.

2.2 Impact of SAM

Severe acute malnutrition in children under five years of age remains a major public health problem, especially in low-middle-income countries.[17,18] In 2016, almost 52 million children under five suffered from wasting and 17 million were severely wasted.[19] Most children younger than five years affected with SAM are found in South Asia and sub-Saharan Africa.[1] Malnutrition accounts for 50% to 60% of hospital deaths in sub-Saharan Africa. A study in KwaZulu-Natal found that children were often brought to the hospital too late for management, resulting in the high number of SAM deaths.[20] The Child Healthcare Problem Identification Programme (Child PIP) has

reported that, between 2011 and 2015, 30.9% of deaths in South African hospitals was associated with SAM.[9]

The outcome of SAM has an ultimate consequence throughout the life cycle, including a lower chance of survival, reduced learning in school, decreased economic productivity and increased acute and chronic illness.[20,21] Black et al. reported that children under five with weight-for-height/length less than -3 standard deviation (SD) have nine times higher overall risk of death, compared to children with weight-for-height/length above -1 SD.[22]

Briend and Berkley show that despite treatment, the long-term survival and health of children who were previously treated in hospital for complicated SAM is suboptimum and that more consideration needs to be given to the risk of chronic diseases later in life.[21] In addition, previous small-scale studies suggest that psychosocial stimulation is important for cognitive development during recovery and follow-up.[22]

Children suffering from SAM have weak immunity, which increases the risk of infections. Upper respiratory infections (URIs), dehydration and diarrhoeal disease worsen in children that present with SAM. Most professional health workers treat infectious illness and disregard SAM.[23] Furthermore, the presence of tuberculosis (TB) and human immunodeficiency virus (HIV) have made the classification of SAM more complicated, because the signs of both infections are identical to SAM.[4]

2.3 Challenges with SAM

Most SAM cases are accompanied by other infectious illnesses, such as skin rash, pneumonia, diarrhoea and fever, which make them difficult to identify. The Child PIP has created a system that reveals many modifiable and avoidable factors at all levels of the health system. The modifiable factors are identified in five areas, namely at home, at the referring facility, at casualty, at admission and emergency (A&E), and in the ward. Modifiable factors are classified as “patient-related”, “healthcare worker related”, and “administrative related”. The most common modifiable factor is inadequate notes on clinic care (assessment, management and monitoring).[9]

Modifiable factors were also identified at the PHC level, where many patients first present with health-seeking behaviour. The most common identified modifiable factors are child growth problems (SAM, not growing well) and inadequately

identification/classification. Danger signs, such as not feeding well, raised temperature (>38˚C), drowsiness or unconscious, severe chest in-drawing, severe dehydration, fast breathing and hypothermia<35˚C)[8] missed at PHC level are the other modifiable factor.[9] Proper identifications of these danger signs could leads to proper management and prevention of the severity of SAM.

A number of studies have attempted to explore in-hospital SAM mortality by measuring the quality of in-hospital care through assessing the applicability of the WHO guidelines for malnutrition management.[10] However, there is a need for a complete understanding of the WHO guidelines with a specific focus on the decision to manage and refer the SAM child at PHC level.

2.4 Integrated Management of Childhood Illness

IMCI is an integrated strategy that focuses on the child health well-being. The aim of this guidelines is to provide guidance on proper assessment, classification of nutritional status and management of young children at PHC clinics, in order to reduce the risk of death and disability among children[24]. Recent studies have revealed that many sick children are not correctly assessed and treated by health care workers, and that their parents are poorly advised about care for their children.[25]

This method provides a comprehensive list of all key diseases and its treatments, it includes nutritional counselling messages for caregivers, promotes preventive activities, and facilitates timely referral of gravely ill children to in-hospital care.[26] Studies have shown that adequate training of professional nurses at PHC level in the management of SAM is essential for the effective implementation of IMCI guidelines.[27]

Integrated Management of Childhood Illness guidelines were adopted in South Africa in 1998. Since then, many health workers have been trained in IMCI case management guidelines and all clinics should be implementing the guidelines.[23] However, research has revealed that although the guidelines are implemented, they are not applied correctly or completely.[28] The report *Saving Children 2012–2013* recognised failure to follow IMCI assessment and treatment guidelines and to recognise the severity of illness as modifiable factors responsible for the death of children in South Africa.[9] This corresponds with the findings of Amaral et al. in Brazil in 2004.[29]

Early detection of children with SAM will ensure that more children are identified and treated before developing complications and could reduce the need for hospitalisation.[30] The case fatality rate for SAM ranges between 20% and 30%, with the highest levels (50–60%) among those with oedematous malnutrition.[31] With modern treatment regimens and improved access to treatment, case fatality rates can be reduced to less than 5%, both in the community and in facilities.[27]

Although SAM was not reported as one of the top five leading causes of under-five deaths, about 24% of children who died from pneumonia in South Africa in 2012–2013 were classified as severely malnourished and about 32% were classified as underweight for age. In 2012–2013, almost 40% of the children who died from diarrhoea were classified as severely malnourished.[9] The percentage was higher in children dying from chronic diarrhoea; 51% of these children were classified with SAM. More than 40% of children who died from septicaemia were classified as severely malnourished and 25% were classified as underweight for age.

The IMCI 2014 chart booklet[8] (Figure 2.1) guides professional nurses in case management for SAM. It defines steps for assessment, classification, treatment, counselling the child's caregiver and referring the sick child to the hospital. The nurses are to weigh the children and plot the weight in the Road to Health Booklet (RTHB) and interpret if the child is growing well or not. Thereafter, height/length should be measured and plotted on the RTHB. Mid-upper arm circumference should be measured and recorded too. The table in the IMCI chart booklet is colour coded; if the child's assessment falls within the red area, the child should be referred to the hospital urgently.[8]

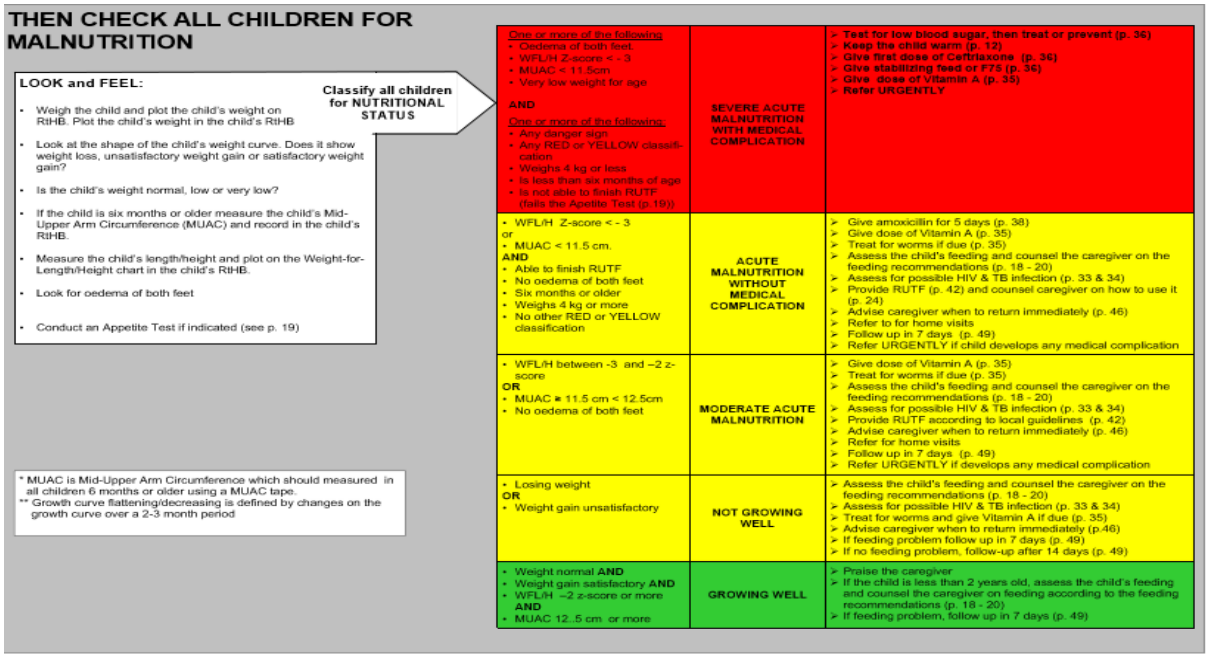

Figure 2.1: An algorithm used in IMCI 2014 guidelines case management to identify and treat malnutrition[8]

2.5 Classification of SAM

Accurate anthropometric measurements are essential to correctly classify and manage children with SAM. Usually, children also present with other co-morbidities at PHC level. In order to reduce case-fatality rates due to SAM, capacity building of the IMCI approach, in order to complement the WHO guidelines for the management of SAM, is vital. In children aged 6–59 months, the IMCI guidelines identify SAM if one or more of the following are present:

- weight-for-height/length < -3 z-score;
- the presence of bilateral pitting pedal oedema;
- mid-upper arm circumference (MUAC) < 11.5 cm; or
- very low weight-for-age or if the weight is < 4 kg[7,8]

AND one or more of the following:

- any danger signs, including not feeding well, raised temperature (>38˚C), drowsiness or unconscious, severe chest in-drawing, severe dehydration, fast breathing and hypothermia (<35˚C)[8];
- any other RED or YELLOW classification;

- weight ≤ 4 kg; or
- not able to finish ready-to-use therapeutic food (RUTF)[8]

Basic anthropometry (weight and height) does not correctly predict body composition, whereas MUAC indicates fat mass in children[31]. Recent literature has argued about classification of SAM using one indicator that is WHZ. A study by Grellety and Golden (2018) has discovered that MUAC alone has failed to classify high numbers of susceptible children in many communities[32].

2.6 Causes of SAM

SAM is a complex social and political challenge. It stems from chronic poverty, lack of education, poor hygiene, limited access to food and poor diets.[7] SAM usually develops because of a decrease in the consumption of food by the individual, resulting in the development of other illness and/or sudden weight loss and/or the presence of bilateral pitting pedal oedema. A decrease in appetite or anorexia and medical complications are other clinical signs that can indicate the severity of acute malnutrition.[30]

2.7 Prevention of SAM

Primary healthcare was created to be a foundation of worldwide health coverage; it is a holistic societal approach to health and wellbeing centred on the individual's need preferences. Nutrition forms the basis for PHC services, through its prevention and promotion of a healthy lifestyle[13]. Maternal and early-life nutrition interventions at health services, have been found to prevent and treat malnutrition in all its forms[33].

The Lancet series (2013) presented a comprehensive guided framework[34] (Figure 2.2), that display detailed interventions and their pathways to optimum foetal and child nutrition and development. The interventions include nutrition-specific interventions that address the immediate causes of suboptimum growth and development.

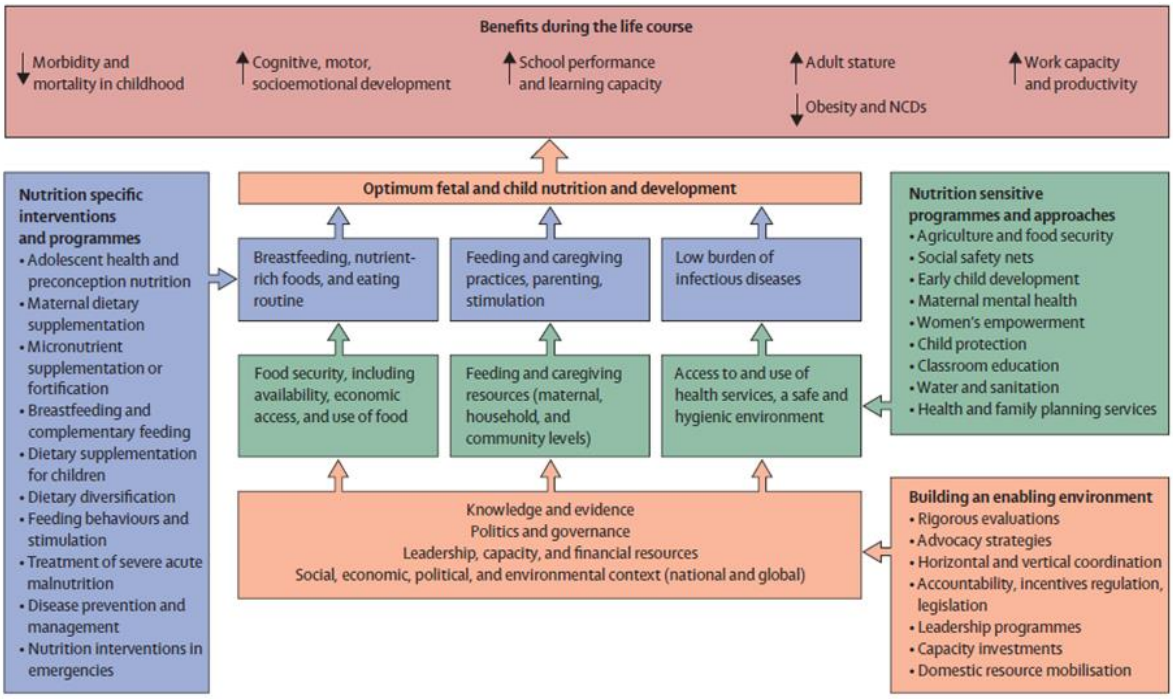

Figure 2.2: Framework for actions to achieve optimum foetal and child nutrition and development[34]

The framework also highlights the possible impact of nutrition-sensitive interventions that address, among others, the underlying causes of SAM and integrate specific nutrition goals and actions for optimal impact.[34] Most of the nutrition-specific interventions are delivered at PHC level, indicating the importance of this first level of care.

Prevention and long term solutions for SAM involve undoing unequal power structures, improving equitable access to health services and nutritious foods, promoting breastfeeding and optimal infant and young child feeding practices, improving water and sanitation, and planning for cyclic food shortages and emergencies. [34]

2.8 Management of SAM at PHC

Mortality in children with acute malnutrition is directly correlated to severity: moderate wasting is linked to a mortality rate of 30–148 per 1 000 children per year and severe wasting to a mortality rate of 73–187 per 1 000 children per year.[35,36] The WHO recommends that every child classified with SAM at PHC level should be referred to hospital.[7] Furthermore, the South African guidelines on the integrated management of children with acute malnutrition state that all cases of SAM, whether with medical

complications or not, are to be referred to hospital – this includes children with nutritional oedema.[4] Evidence-based studies have shown that implementing IMCI correctly could reduce the mortality rate by 5%.[37]

The IMCI guidelines for managing SAM at PHC level can be implemented as the stabilisation phase, in line with the WHO's guidelines for managing SAM. The stabilisation phase is important to prevent complications that could lead to mortality in a child with SAM within 1–7 days of admission to hospital.[38] Complications such as hypothermia, hypoglycaemia, electrolyte imbalance, dehydration and infections are the leading cause of mortality in children with SAM. Hypothermia and hypoglycaemia usually occur together and are indications of infection. Measuring and managing temperature is important for preventing hypothermia.[20] Nurses are encouraged to provide children with SAM with F75 as a feed to prevent hypoglycaemia and electrolyte imbalance.[8]

Prevention of complications of SAM is crucial. The WHO recommends that nurses follow a therapeutic protocol for vitamin A.[7] They should administer the first dose of vitamin A at PHC facilities before referring children with SAM to hospital. Also, children with SAM have hidden infections. The WHO has suggested that children that pass the appetite test should be given amoxicillin and those that fail the appetite test should be given ceftriaxone for seven days or more.[7] A study conducted by Trehan et al. in Malawi has shown that the addition of antibiotics to therapeutic routines for uncomplicated SAM was associated with early recovery and lower case fatality.[39]

In summary, it can be said that SAM is a public health problem, which can be detected through a step-by-step method of assessment and treatment. However, the high level of missed opportunities at the PHC level is concerning.

CHAPTER 3: METHODS

3.1 Introduction

This chapter outlines the research question, aims, objectives, research design, methods of data collection, research instruments, data analysis and ethical considerations of the study.

3.2 Research question

The research question for this study was as follows:

How are children who are ill and attending PHC facilities in the JHB district assessed and managed for SAM?

3.3 Aim

The aim of the study was to evaluate the assessment and management of SAM in children aged 6–59 months by professional nurses at PHC facilities in the JHB district.

3.4 Objectives

The study objectives were the following:

3.4.1 To identify all children aged 6–59 months who were classified with SAM according to IMCI guidelines from 1 April 2016 to 31 March 2017 in PHC facilities in the JHB district.

3.4.2 To identify all children aged 6–59 months who were “missed opportunities”, i.e. not classified as SAM but according to the data from clinic files were SAM cases.

3.4.3 To describe the proportion of children aged 6–59 months with SAM in PHC facilities in the JHB district who were referred to hospital for further management as a proportion of children in the same age category in the same district who were correctly assessed, classified and treated for SAM.

3.4.4 To identify the number of PHC facilities that had nutritional supplements for SAM cases.

3.5 Study population

The study population was all sick children, according to the IMCI guidelines, aged 6–59 months who attended JHB district clinics between 1 April 2016 and 31 March 2017.

3.6 Inclusion and exclusion criteria

Records of all children between the ages of 6 and 59 months who were classified with SAM, according to the IMCI guidelines, and attended the clinics between 1 April 2016 and 31 March 2017 were included. Records of all children who were sick between the ages of 6 and 59 months who were classified with other illnesses (e.g. diarrhoea, pneumonia, fever) and showed other danger signs (such as not feeding well; raised temperature, >38˚C, drowsiness or unconscious; severe chest in-drawing; severe dehydration; fast breathing and hypothermia, <35˚C) according to the IMCI guidelines, and who attended the facility between 1 April 2016 and 31 March 2017 were also included.

Records of all the children below the age of 6 months and above 59 months who were classified as SAM, according to the WHO, were excluded. Records of children referred for another diagnosis other than SAM, or IMCI illnesses or danger signs were also excluded. Children who attended the PHC facility for the Extended Programme of Immunization (EPI) and growth monitoring and promotion (GMP), were excluded.

3.7 Study sites

The study was conducted in the JHB district. The district is divided into seven subdistricts (Figure 3.1) of which the most prominent, economically viable, is subdistrict E, the Sandton/Alexandra region. This subdistrict, as the financial service hub of the country, and subdistrict F, which houses the manufacturing cluster, are key drivers of economic growth in JHB. These two subdistricts also have a high concentration of head offices and government institutions.

Figure 3.1: JHB district and subdistricts[40]

The less prosperous regions include sub-district G – the deep South, Ennerdale and Orange Farm – with a gross domestic product of about one-tenth of the economic size of sub-district E. Subdistrict D and G are the most populated, home to 27% and 17% of the city's population, respectively. These two sub-districts also have the highest unemployment rate, 43% and 28%, respectively. The seven sub-districts are composed of 135 wards, two district hospitals and 107 PHCs. Of these, 27 are managed by the provincial health authority, 80 by local municipalities and 10 are community health centres (CHCs), all of which follow the IMCI guidelines to assess and manage SAM in children.

PHCs and CHCs were targeted since all sick children are seen at PHCs and CHCs for preventive or curative services and are screened for SAM by professional nurses through the evaluation of their anthropometric measurements. If children are found to have SAM with or without complications, they should be referred to hospital. The assumption was that all professional nurses working in IMCI should have received training. Assessing how these professional nurses classify and manage children presenting with SAM would reflect the basic knowledge levels and the need for further in-service training. The researcher collected the data from 35 clinics in the JHB district. Table 3.1 summarises the clinics visited (n = 35) and the number of files reviewed (n = 1 189).

Table 3.1: Clinics visited, number of files reviewed and number of files that met the criteria

Clinic code	Subdistrict	Number of files reviewed	Number of files that met criteria
1	A	50	4
2	A	15	4
3	A	No records kept*	0
4	A	46	3
5	A	74	6
6	A	50	5
7	A	15	5
8	A	No records kept*	0
9	B	20	0
10	B	20	3
11	B	15	1
12	C	15	0
13	C	10	2
14	C	50	0
15	C	7	4
16	C	7	4
17	D	No records kept*	0
18	D	55	0
19	D	20	2
20	D	35	1
21	D	25	4
22	D	30	5
23	D	75	5
24	D	60	0
25	E	10	0
26	E	73	3
27	E	50	3
28	G	50	4
29	G	70	1
30	G	10	5
31	G	15	6
32	G	50	0
33	G	50	0
34	G	50	0
35	G	75	3
Total	6 regions	1 189	83

*Records of patients are to be kept at the clinic. In these clinics, no records were kept.

3.8 Sample selection and size

Initially, 24 PHC facilities (local and provincial government) from the seven sub-districts were randomly selected for data collection. The researcher used the sampling frame map for all the clinics in the JHB district, as well as the list of clinics in all sub-districts, to select the 35 participating clinics. The sample size was calculated (Table 3.2) using Epi Info statistical software version 7.2.2.6.

The option of sample size and power was selected, followed by a selection of population survey or descriptive study. The population size of the JHB district (387 106) was entered, with an expected frequency of 50%, an acceptable margin of error of 5%, design effect of 1.0 and cluster size of 7 (which represented the seven sub-districts of the JHB district).

Table 3.2: Sample size calculation for the files to be reviewed at the clinic level for each sub-district

Confidence level	Cluster size	Total size
80%	24	168
90%	39	273
95%	55	385
97%	68	476
99%	95	665
99.9%	155	1 085
99.99%	216	1 512

Population size: 387 106

Expected frequency: 50%

Confidence limits: 5%

Design effect: 1.0

Clusters: 7

3.9 Research design

This was an observational study with a cross-sectional, retrospective, descriptive study design. Quantitative data collection methods were used to review clinic records

of children between 6 and 59 months of age who were treated for SAM according to IMCI 2014 guidelines in PHC facilities in the JHB district from 1 April 2016 to 31 March 2017.

3.10 Data collection

A non-random, convenience sampling strategy was used to select the files at all the clinics. Data were collected by the principal investigator. The clinic manager of each clinic signed the consent form (Addendum A) to allow access to clinic records. All clinic files of children who were classified with diarrhoea, pneumonia and SAM between 01 April 2016 and 31 March 2017 were reviewed. Data were collected in line with the study objectives and were recorded on a data collection sheet (Addendum B) and compared to the IMCI recording form (Addendum C). Weight-for-height/length and weight-for-age (boy or girl) were plotted (Addenda D and E).

The data collection tool and process followed the sequence of the objectives of the study.

1. *To determine all children aged 6-59 months that were classified for SAM according to IMCI guidelines and to identify all children aged 6-59 months that were "missed opportunities", i.e. not classified for SAM but according to the data from clinic files were SAM cases.*

   The first section of the data tool collected data outlining demographic information, anthropometric measurements, malnutrition classification and the presence of other illness on the first consultation with the child. The patient's clinical signs and vital observations recorded in the clinic file were collected. Subsequently, data were collected regarding initial observations done by nurses. These included checking temperature and blood glucose.

2. *To assess the management practices of SAM against the key principles of management outlined by the IMCI guidelines for managing children with SAM*

   The second section of the data collection tool assessed whether nurses recorded information in the files that indicate that the nurses excluded the presence of hypothermia, hypoglycaemia and infection and initiated management in line with the IMCI guidelines in order to avoid any of these preventable complications.

3. *To identify the number of children that had SAM according to anthropometric measurements (Addenda D and E) but were not referred to hospital.*
4. *To identify the number of clinics that had the equipment needed to classify and manage children with SAM. These included paediatric scales, stadiometers/length boards, MUAC tapes, stabilisation feeds or F75, RUTF and supplement-enriched porridges.*

3.11 Data analysis

Before entering the data into a Microsoft Excel spreadsheet, data were coded and sorted, and errors or omissions were checked. Based on the study design and the objectives, descriptive statistics were used. Continuous data were summarised by using means and standard deviations. Categorical variables were summarised by numbers and percentages.

3.12 Ethics

The research proposal was approved by the Health Research Ethics Committee of Stellenbosch University (HREC reference no: 1-2018-0752) (Addendum F). Permission to conduct the study in the JHB clinics was granted by the Gauteng Department of Health (reference no: Gp_201807_036) (Addendum G). Confidentiality of patients was not breached, and no human subjects were involved in the study. Codes were used to refer to clinics. Regarding data entry, the study database was password protected and only the principal investigator, the study leaders and the statistician had access to the data.

CHAPTER 4: RESULTS

4.1 Introduction

Chapter 4 outlines the study setting, data analyses and findings.

4.2 Study setting

The study was conducted in the JHB health district clinics. All subdistricts were covered during data collection. The pilot study was conducted in one subdistrict and the results were not included in the main study. Only 35 clinics were visited by the researcher to collect data.

4.3 Data analyses and findings

A total of 1189 clinic files from 35 clinics were reviewed. Only 83 files (Table 4.1) were included in the study on the basis of the inclusion and exclusion criteria. Of the 83 files, 44 (53%) represented boys and 39 (47%) girls, with a median age of 11 months (standard deviation [SD] 8.8). Two children (2%) were previously classified with SAM. With regards to anthropometric measurements, 81 (98%) of the children had their weight formally recorded while only 28 children (34%) had their height/length recorded. Twenty-eight children (34%) had their weight-for height/length measurement and calculation recorded in their files. Twenty children (24%) had an MUAC measurement recorded in their file.

Five children (6%) were underweight-for-age on the growth chart but were recorded having SAM in the clinic file. There were two children (2%) that had no record of their classification of nutritional status, despite being classified as having SAM and referred to hospital for management, also had no description of oedema, thus the researcher could not assign a probable malnutrition classification. Sixty-five (78%) children were not classified for SAM by professional nurses according to IMCI guidelines.

On evaluating the completeness of files with respect to oedema, 12 children (14%) had a record of oedema in their files, 58 patients (66%) had no oedema noted and in 16 patient files (19%) there were no entries regarding the presence or absence of

oedema. In the 12 files in which oedema was recorded, the severity of the oedema was graded or described: one patient had grade 3 (+++) oedema, 7 had grade 2 (++) oedema and 4 had grade 1 (+) oedema.

Table 4.1: Summary of data from the sample of clinic records of children aged 6–59 months classified with SAM according to IMCI guidelines from 1 April 2016 to 31 March 2017 in PHC facilities in the JHB health district

	n = 83	**%**
Boys	44	53
Girls	39	47
Previously classified with SAM	2	2
Weight taken	81	98
Height taken	28	34
MUAC taken	20	24
Weight-for-height/length	28	34
Underweight for age	5	6
No weight, height, MUAC but classified as SAM	2	2
Number of children who were presenting with SAM (using WHZ chart) and not classified by PN	65	78
Oedema present	12	14
The severity of oedema: Grade 3 Grade 2 Grade 1	1 7 4	8 58 33
Feeding mode: Breastfeeding Formula feeding Solid food No record of feeding	18 49 26 32	35 96 51 39
Presence of other illness	70	84
Correct classified as having SAM	14	17

Professional nurses assessed and recorded the feeding practices of 51 (61%) of children. Of these, 18 (35%) were recorded as still breastfeeding, 49 (96%) were recorded as given formula milk and 26 (51%) were receiving solid food. Thirty-two children (39%) were not checked for feeding by the nurses according to the clinic files. Failure to check for feeding in children that are sick could lead to poor classification of SAM.

According to the growth charts that were used by the principal researcher (Addendum D and E), 65 (78%) of the children presented with SAM but were not classified as such in the clinic records. Proper classification of SAM by professional nurses at the clinic, only 14 children (17%) were classified according to IMCI guidelines. These children's

weight, height/length and MUAC were taken, recorded and SAM was classified. Only 71 (85.5%) of the children were assessed for co-morbidities (see Figure 4.1). These included the presence of diarrhoea, TB, pneumonia and HIV. The predominant illnesses that were identified were diarrhoea (47%), pneumonia (39%), TB (6%) and HIV (6%).

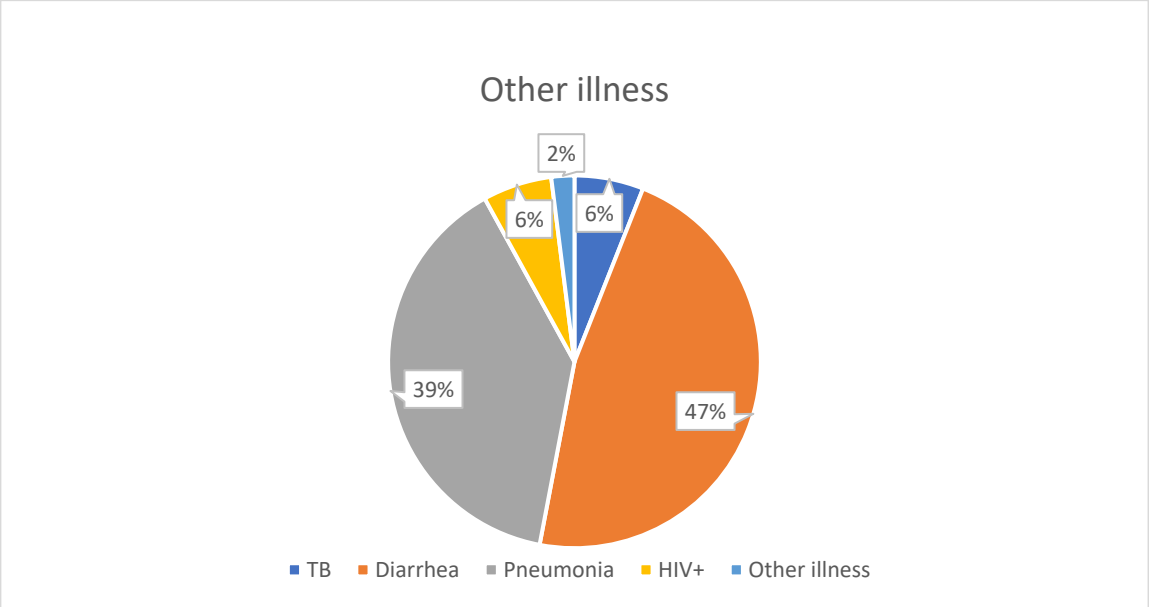

Figure 4.1: Other illnesses assessed at clinics and recorded in clinic files

The equipment that were reported being available at clinics are represented in Figure 4.2. All the clinics had paediatric weighing scales, stadiometers/length boards and MUAC tapes. Only 2 clinics (5.6%) had stabilisation or F75 supplementary feeds. Fifteen clinics (43%) had RUTF and only 27 (77%) had enriched porridge for supplementation.

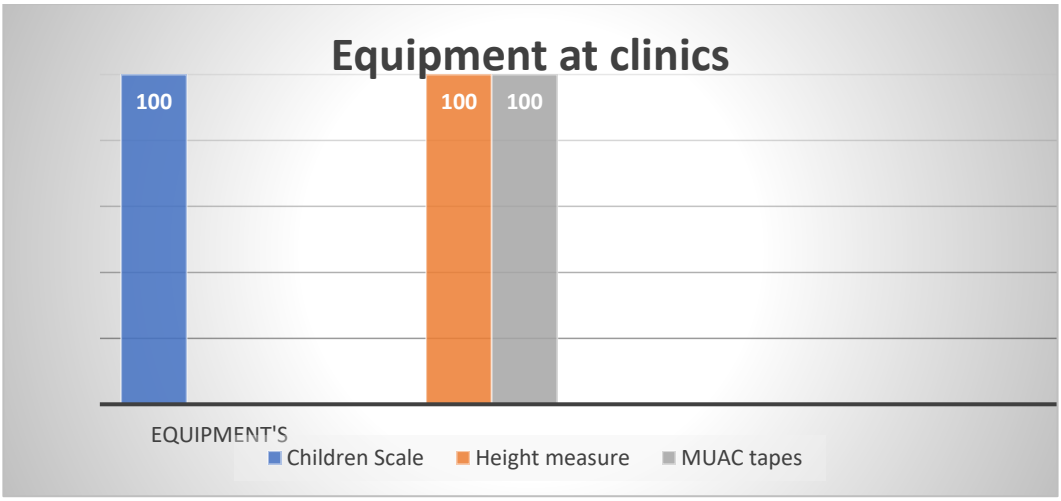

Figure 4.2: Equipment at clinics in the JHB district

Actions that were taken at the PHC by nurses after the children were classified with SAM are summarised in Table 4.2. Sixty-two (75%) of the children's temperature was recorded, but only 12 children (20%) had blood glucose results in their files. Children with SAM are at high risk of death if blood glucose is not tested and temperature not taken. Forty-two (51%) of the children were given the first dose of ceftriaxone, 44 (53%) were given vitamin A and 51 (61%) were given deworming. Two (2.4%) of the children were tested for appetite at the clinics and two (2.4%) of the children were given stabilising feeds or F75.

Table 4.2: Recorded treatment given at the clinic before referral to hospital

Treatment at the clinic	**n = 83**	**%**
Temperature taken and recorded	62	75
Blood glucose tested and recorded	17	20
The first dose of ceftriaxone given and recorded	42	51
A dose of vitamin A given and recorded	44	53
Appetite test done	2	2.4
Stabilising feed or F75 given	2	2,4
Deworming given	51	61
Immunisation status checked and given if needed	53	64
Children correctly classified with SAM and referred to hospital	3	21
Children admitted to hospital followed up at the clinic	29	35

Fifty-three (64%) of the children's immunisation status was checked and immunisation given if needed. Only three of the 14 children that were classified correctly for SAM

were referred to hospital; 78% were not referred at all, even though the IMCI guidelines state that they should be referred urgently. Twenty-nine children (35%) were followed up at the clinics after they were admitted to hospital. One child (1.2%) died at hospital because of the complications of SAM; according to the clinic file, this child had not been classified correctly.

CHAPTER 5: DISCUSSION

5.1 Introduction

The IMCI guidelines were developed to assist professional nurses at PHC level to assess, classify and treat sick children under five years old. Nutritional assessment is part of the IMCI guidelines. The IMCI guidelines state that all children under five who are sick should undergo a nutritional assessment to determine nutritional status and be classified accordingly.[8]

The purpose of this study was to review the assessment, classification and management of SAM by professional nurses at PHC clinics in the JHB health district.

The study found a consistently poor level of classification of SAM using IMCI guidelines at all clinics. This has a knock-on effect on the quality of management and treatment of patients with SAM at the hospital level. The poor implementation of the classification of SAM has a negative impact on the number of SAM cases recorded by clinics in DHIS within the JHB district. A study by Mulaudzi[41] in Tshwane also found that IMCI guidelines were not followed in the assessment and management of children by clinic healthcare workers. A study conducted in Burundi[42] also found low compliance with IMCI guidelines.

5.2 Classification of SAM

Nutritional assessment is essential for the classification of SAM. The results of this study show that most of the children in this study were not accurately assessed for SAM. The classification of SAM was incomplete and incorrect in most of the cases, as only 14 children were correctly classified according to IMCI guidelines. Weight was recorded and used to classify most cases of SAM in this study, these findings concurs with a study by Antwi[43] in Ghana. Weight-for-length/height and MUAC were not recorded and used by nurses to classify SAM.

Due to missing height measurement in most of the files in the current study, weight-for-height measurements could not be checked to assist in differentiating children in the sample suffering from wasting versus stunting. This means there could have been an incorrect classification of cases since only weight-for-age measurement was

recorded and was used and no MUAC was available in most files to verify classification.

IMCI guidelines use these two indicators to classify children with SAM together with weight-for-age if the birthweight is known. Similar results were found by Antwi[43] in Ghana, in that interpretation of weight on growth charts and follow-up of the children that were not growing well were not done by nurses.

In total, 65 (78%) children had SAM after the reviewed clinic files by the researcher; these children were misclassified by professional nurses. The challenge with incorrect classification of SAM is concerning given that the case definition of malnutrition is essential in identifying the vulnerable malnourished child in order to initiate treatment as per IMCI guidelines at PHC. Misclassification may resulted in missed opportunities to address the severity of malnutrition and to prevent mortality in children. This was also found in studies by Chopra et al.[28] in Cape Town Horwood et al.[40] conducted in KwaZulu-Natal in 2009, Mulaudzi[41] in Tshwane in 2015

Nutritional oedema was poorly identified in the study sampled. Children with nutritional oedema have a high risk of mortality.[4,7] The presence of oedema completely changes the classification of a child from normal or MAM z-scores to SAM, also when using MUAC. Nutritional oedema requires prompt and complete treatment. In the current study, only 14% of the children were classified as having nutritional oedema. Failure to detect nutritional oedema early may lead to insufficient treatment and eventually, complications of SAM.[7] Nineteen per cent of the children in this study were not classified or recorded for oedema. Similar results were presented in a study by Nimpagaritse et al. in Burundi.[42]

5.3 Management of SAM at PHCs

The management of SAM has three phases: stabilisation, transition and rehabilitation. The objectives of the stabilisation phase are to detect low blood sugar, low body temperature and poor feeding.[4] At PHC level, the stabilisation phase is guided by the IMCI guidelines. The purpose of this phase is to control infection, restore cellular function, for the child to receive proper dietary support and to ensure that the child is kept warm.[4] Children with SAM are at high risk of death if blood glucose levels are not tested and temperatures are not taken[38]. Nurses' testing of blood glucose to prevent

hypoglycaemia was done poorly in this study. Studies have shown that hypoglycaemia is a leading cause of death in SAM cases. In this study, only 20% of the children's blood glucose was tested. The results of this study concur with those of the study conducted by Mulaudzi[41] in Tshwane in 2015.

Children with SAM are susceptible to hypothermia.[4] The IMCI guidelines state that the temperature of children should be taken to prevent hypothermia. In this study, this was poorly done: only 75% of the children had their temperature taken and recorded in their clinic files.

Clinical studies have recorded the elevated prevalence of bacterial, urinary tract infections and pneumonia in children with SAM, although in most cases there were not any symptoms of infection.[7] For bacterial infection (septicaemia), IMCI recommends that children with SAM should be given the first dose of ceftriaxone at the clinic to prevent infections.[8] However, in this study, it was found that few children with pneumonia and SAM received the first dose of ceftriaxone, as it was documented in only a few of the files at the clinic. The results were similar to other reports in different settings. A study by Mulaudzi,[41] for example, found that children with severe pneumonia who had been referred to Kalafong hospital were not given ceftriaxone.

The IMCI guidelines recommend that professional nurses check the child's immunisation, vitamin A and deworming status.[8] Nurses are supposed to check whether immunisations, vitamin A and deworming are up to date according to the RTHB. If the child missed any of the immunisations as per the schedule, the clinic should give the missed doses or do catch-up immunisation. An additional treatment dose of vitamin A should be given for SAM, persistent diarrhoea, measles or xerophthalmia. The results of this study show that immunisation, vitamin A and deworming, as catch-up preventative dosages or treatment, were not documented.[8]

Feeding history is critical in all paediatric consultations but is often ignored by professional nurses in PHC settings in low-income countries.[42] Breastfeeding is known to reduce mortality in young children and infants. This study has revealed that feeding practices were not documented in the clinic files.

The appetite test is a pre-referral requirement to conclude the classification of SAM in children according to the IMCI guidelines. Professional nurses are encouraged to conduct an appetite test using RUTF with children that were classified as SAM. If the

child fails the test, the child should be referred to the hospital for treatment of SAM. This study found that appetite tests at clinics were rarely done. Only two children were given an appetite test.

All the clinics that were visited had the necessary equipment to classify SAM, such as paediatrics scales, stadiometers/length boards and MUAC tapes. None of the clinics reported that their equipment was not working. It was found, however, that stock-outs of nutritional supplements (RUTF, F75 and enriched porridges) occurred in most clinics. This could be the reason why appetite tests were rarely done.

Some of the clinics have not had these nutritional supplements for some years. This negatively affects the implementation of IMCI guidelines, including doing the appetite test and follow-up treatment. Children that were discharged from hospital for follow-up at clinic level did not receive the required supplements, which could lead to a relapse in some children.

Children diagnosed to fall in the red category according to the IMCI guidelines must be referred to hospital urgently. Children with SAM with medical complications or with oedema must be referred to hospital for further inpatient management. In this study, the referral of SAM cases was poorly done. Some SAM cases were not referred to hospital at all and other cases were classified as SAM even though they were not SAM cases.

5.4 Limitations of the study

This study was a retrospective review of clinic files. The level of staff training was not assessed, and clinical management of cases was not observed when it occurred. Furthermore, this study was unable to determine the adherence to IMCI guidelines between the clinics and the sub-district visited. Some facilities did not have proper IMCI forms and were using PHC stationery. This presented challenges for the IMCI classification flow.

The researcher acknowledges that over-representation of specific clinics or individual patients due to convenience sampling caused an abnormal distribution and that certain statistics may be slanted.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The aim of the study was to evaluate the assessment and management of SAM in children aged 6–59 months by professional nurses at PHC facilities in the JHB district. This study found that in all the clinics visited, professional nurses did not adhere to the IMCI guidelines when they classified sick children and children with SAM. The IMCI guidelines were used to assess sick children with fever, diarrhoea, pneumonia and cough correctly, but they failed to classify SAM in sick children because the only weight was used to classify SAM. Overall, the extent to which the IMCI guidelines were implemented was limited to clinic files discovered that professional nurses struggled to recognise SAM as an illness. They lacked information on the importance of adhering to the IMCI chart booklet framework to provide effective care in order to minimise the morbidity and mortality of children with SAM.

The results showed poor usage of the IMCI chart booklet by professional nurses, which points to an urgent need for upscaling skills in the classification of SAM. The information in the clinic files recorded by the professional nurses was not detailed regarding the initial classification of SAM, nor were the assessment and explanation of children's medical condition recorded. This indicates that the prompt to initiate prevention and management of co-morbidity of SAM was absent, which means that the guidelines are consequently not followed, resulting in poor monitoring, inadequate treatment interventions and failure to act when problems arise.

Blood glucose levels were checked and managed correctly in only a few cases. To prevent hypoglycaemia, IMCI recommends the use of F75. Only two clinics had this feed available. Most of the clinics did not have nutritional supplements for the children who needed it after being discharged from the hospital. This could lead to a situation where children who were recovering from SAM would not improve. No RUTF was found at most clinics that were visited. Most of the clinics reported that they have never seen RUTF. This indicates a failure by the District Nutrition Programme to procure and supply the nutritional supplements to all clinics and to support the clinics in the implementation of IMCI guidelines and targeted supplementation.

6.2 Recommendations

The following recommendations are made based on the findings of this study.

1. Nutritional screening should be done for all the children who attend PHC clinics. Weight, height and MUAC measurements should be plotted in the Road to Health booklet and recorded in the child's clinic file.
2. Professional nurses should identify and treat or prevent hypoglycaemia, hypothermia, dehydration, vitamin deficiencies and any other problems before referring the child to the hospital. The District Nutrition Programme together with Child Health should continuously monitor and evaluate the implementation of the IMCI guidelines and monitor related case management.
3. The District Nutrition Programme should ensure that adequate nutritional supplements are supplied and monitored at all clinics by supporting supply chain management.
4. Clinic managers should ensure that facilities have enough supplements for children who qualifies and requires this intervention.
5. Professional nurses should encourage mothers and caregivers to bring their children to the clinic for GMP to ensure the early detection of acutely malnourished or at-risk children. This can also be achieved by training community health workers or ward-based outreach teams to identify SAM by using anthropometric assessments, including the use of MUAC tape.

More studies should be done to assess whether factors such as lack of human resources, lack of training or experience, staff knowledge and motivation play a role in the poor implementation of IMCI guidelines in treating children with SAM before referring them to hospital.

Early detection of SAM can be achieved through proper implementation of the GMP along with the EPI. The EPI should not focus only on the immunisation of young children but should be concerned with their growth and health as well. As suboptimal feeding of infants younger than six months may lead to the development of SAM, it is important that feeding practices should be addressed during immunisation visits. This study has therefore revealed the gap between the EPI and IMCI in the JHB district.

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ADDENDUM A. Permission to review the clinic records

A permission to Review the clinic records for Clinic Manager

20 Krone Street

Lewisham

Krugersdorp

1739

Dear Clinic Manager

Thank you for your willingness to be informed about the research study and your clinic's potential involvement. I, Mr. Simon V Shabangu, am currently enrolled in the Master of Nutrition programme at the Division of Human Nutrition, Stellenbosch University. The title of my study is "**Management of Severe Acute Malnutrition in children aged 6-59 months by Professional Nurses in Primary Health Care Facilities in Johannesburg Health District, South Africa: a retrospective analysis**". I hereby request to obtain information from the medical records of the children 6 to 59 months that were assessed and treated for child illness that attended your facility between April 2016 to March 2017. This research is not designed to impact directly on the patients whose clinical records are being accessed.

The Stellenbosch University Health Research Ethics Committee has approved the research proposal. (Reference number: 0752). Please find the summary of the protocol attached. The permission to conduct the research at Johannesburg district health facilities has been granted by district research committee. The individual patients to be included in the study will be identified by means of a number, and no names will be recorded. The names of the professional nurses, who did the assessments and recorded the information, will also not be included in the process of data collection.

The findings of the study will identify any aspects of nutritional assessment at primary health care level to identify severe acute malnutrition, if any, that need to be prioritised in order to improve the outcome of the treatment of severe acute malnutrition. The study results will be published in a thesis to be presented in partial fulfilment of the requirements for the degree of Master of Nutrition in the Faculty of Health Sciences at Stellenbosch University and will be available online after the graduation. The results will also be communicated to the district management team, clinics and the programme managers for Mother, Child and Women's Health and Nutrition.

By giving permission to collect data at your facility, you can be assured that the services at the facility will not be affected during the time of data collection. I, the principle researcher will spend one day (±4 hours per day) at your facility. I will request the files of the previous year and room to work in it, I will review the files on the

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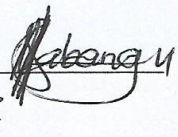
premises and no files will be taken form the premises. Neither will any copies of the content of files be made, nor will pictures of the content of files be taken.

Your permission to review the clinic's records for the study at your facility will be highly appreciated.

Kind regards,

Mr S. V. Shabangu

Principle Researcher:  Student No: 20368607

Date: 10/12/2018

Permission by the Facility manager

Name of the Manager

Name of Facility

Signature of the Manager

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ADDENDUM B: Data collection tool*

		Office use only
	Questionnaire number	☐☐☐
	Date questionnaire completed D D M M Y Y ☐☐☐☐☐☐	
Demographic information		
1	**Name of clinic** _____	☐☐
2	**Subdistrict** _____	☐☐
3	Date of Birth D D M M Y Y ☐☐☐☐☐☐	
4	Gender Male ☐ Female ☐	☐ (1= Male: 2= Female)
5	Date of the clinic visit D D M M Y Y ☐☐☐☐☐☐	
6	Previously classified with SAM YES ☐ NO ☐	☐ (1=Yes;2=No)
Assessment on the day of the clinic visit		
7	Weight _____ YES ☐ NO ☐	☐☐.☐
8	Height _____ YES ☐ NO ☐	☐☐☐.☐

9	Weight-for-height _____SD	☐ <-3SD = 1 ≥-3SDand < -2SD = 2 ≥-2SD =3
10	MUAC _____cm	☐ (<11.5cm = 1; >11.5 cm = 2)
11	Oedema present? YES NO	☐ (1=Yes;2=No)
12	The severity of oedema? Gr.1 Gr.2 Gr.3	☐ (Grade1=1; Grade2=2; Grade3=3)
13	Classification of SAM? YES NO 1. With complications 2. without complications	☐ (1=Yes; 2=No)
14	Presence of other illnesses YES NO 1. Diarrhoea 2. Pneumonia 3. Otitis media 4. Other (name): _____	(1=Yes &2=No) ☐ ☐ ☐ ☐

The information recorded (compare to Addendum C, D and E)				
		YES	NO	(1= Yes, 2= No)
15	Was weight recorded?			
16	Was the mode of feeding recorded?			
17	Was height recorded?			
18	MUAC was recorded?			
19	Was WFL/H recorded?			
Child's feeding				
		YES	NO	(1= Yes, 2= No)
20	Breastfeeding			
21	Formula feeding			
22	Appetite test was done using RUTF			
23	Able to finish RUTF			
Availability of stock/equipment				
		YES	NO	(1= Yes, 2= No)
24	Are porridge supplements available at the facility?			
25	Was F75 available at the facility?			
26	Are MUAC tapes available at the facility?			
Management				
		YES	NO	
27	Was blood glucose tested?			
28	Was blood glucose recorded?			
29	Was body temperature recorded?			
30	Was Mebendazole recorded as given?			

31	Was Vitamin A recorded as given?				(1=		Yes,
32	Was stabilizing feed (F75) given?				2=		No)
33	Was the first dose of Ceftriaxone given?						
34	Was immunization up to date? If not						
35	Was immunization given?						
36	Was the child referred to hospital?						

* The reference to the IMCI guideline

ADDENDUM C: IMCI recording form 2 months to 5 years

Name: _____ Age: _____ Weight:_____kg Temp:_____°C Date: _____

What are the child's problems? _____ ☐ Initial Visit ☐ Follow-up Visit

CHECK FOR GENERAL DANGER SIGNS ☐Yes ☐No ☐ **NOT ABLE TO DRINK OR BREASTFEED** ☐ **CONVULSIONS DURING THIS ILLNESS** ☐ **VOMITS EVERYTHING** ☐ **LETHARGIC OR UNCONSCIOUS**	**Always classify**
COUGH OR DIFFICULT BREATHING? ☐ **Yes** ☐ **No** For how long?_____days Counted_____breaths per minute ☐ Fast breathing ☐ Chest indrawing ☐ Stridor ☐ Wheeze **If wheeze**, ask: ☐ Wheeze before this illness ☐ Frequent cough at night ☐ Wheeze for more than 7 days ☐ Treatment for asthma at present	
DIARRHOEA? ☐ **Yes** ☐ **No** For how long?_____days General condition: ☐ Blood in the stool ☐ Lethargic or unconscious ☐ Restless or irritable How much / what fluid mother has given: ☐ Sunken eyes ☐ Not able to drink/drink poorly ☐ Drinking eagerly, thirsty Pinched abdomen skin goes back: ☐ Normally ☐ Slowly ☐ Very slowly (> 2 secs)	
FEVER (by history or feel or 37.5℃ or above)? ☐ **Yes** ☐ **No** Fever for how long?_____days ☐ Stiff neck ☐ Bulging fontanelle ☐ Malaria Risk. **If malaria risk:** Malaria Test: ☐ Positive ☐ Negative ☐ Not done	
MEASLES? ☐ **Yes** ☐ **No** ☐ Fever ☐ Measles rash ☐ Runny nose, or Cough or Red eyes ☐ Contact with measles ☐ Pneumonia ☐ Symptomatic HIV infection ☐ Cornea clouded ☐ Deep mouth ulcers ☐ Mouth ulcers ☐ Eyes draining pus	
EAR PROBLEM? ☐ **Yes** ☐ **No** ☐ Ear pain ☐ Wakes child at night? ☐ Pus seen draining from ear. ☐ Ear discharge reported: for_____days ☐ Tender swelling behind the ear	
SORE THROAT? ☐ **Yes** ☐ **No** ☐ Runny nose ☐ Cough ☐ Rash	
CHECK FOR MALNUTRITION **All children** Weight: ☐ Very Low Weight ☐ Losing weight ☐ Weight gain unsatisfactory ☐ Weight gain satisfactory MUAC: ☐ < 11.5cm ☐ ≥11.5 and< 12.5cm ☐12.5cm or more Weight for Height/length: ☐ z-score < -3 ☐ z-score ≥-3 and -2 ☐z-score ≥ 2 or more Oedema of both feet: ☐ Yes ☐No Appetite test: ☐Able to finish RUTF ☐ Not able to finish RUTF	**ALWAYS classify**:
CHECK FOR ANAEMIA **All children** ☐ Severe Pallor ☐ Some Pallor ☐ No Pallor If pale**, Haemoglobin measured gm / dl**	**ALWAYS classify**:
CONSIDER HIV INFECTION **All children** **Has the child had an HIV test?** If yes, what was the result? ☐ Pos HIV test ☐ Neg HIV test If Test Positive: is child on ART ☐ Yes ☐ No If no test, has the mother had an HIV test? ☐ No test ☐ Pos HIV test ☐ Neg HIV test **And:** ☐ Pneumonia now ☐ Unsatisfactory weight gain ☐ Persistent diarrhoea now or in past 3 months ☐ Oral thrush ☐ Ear discharge now or in the past ☐ Parotid enlargement ☐ Low weight for age ☐ Enlarged glands in 2 or more of: neck, axilla or groin	**ALWAYS classify**
TB RISK **All children** ☐ Close TB contact ☐ Cough for 3 weeks ☐ Loss of weight ☐ Fever for 7days ☐ NOT GROWING WELL **All children with HIGH RISK OF TB or RISK OF TB must have full TB assessment and be classified**	**ALWAYS classify**

ASSESS CHILD'S FEEDING **if anaemia, not growing well or age < two years**

How are you feeding your child? _____

☐ Breastfed:_____times during the day. ☐ Breast fed during the night

☐ Given other milk:_____type. Using_____to give the milk.

Other milk given_____times per day. Amounts of other milk each time:_____

☐ Given other food or fluids. These are: _____

These given_____times per day. Using_____to give other fluids.

☐ Feeding changed in this illness. If yes, how? _____

If Not Growing Well: How large are the servings? _____

☐ Own serving given. Who feeds the child and how? _____

Feeding problems found:

CHECK IMMUNISATION STATUS AND GIVE ROUTINE TREATMENTS

Underline those that have been given.

Tick those already given

Birth	☐BCG	☐OPV0			
6 weeks	☐DaPT-Hib-IPV1	☐OPV1	☐HepB1	☐PCV1	
10 weeks	☐DaPT-Hib-IPV2		☐HepB2		
14 weeks	☐DaPT-Hib-IPV3		☐HepB3	☐PCV2	
9 months			☐Measles1	☐PCV3	
18 months	☐DaPT-Hib-IPV4		☐Measles2		
6 years	☐Td				

Vitamin A

☐ Yes ☐ No

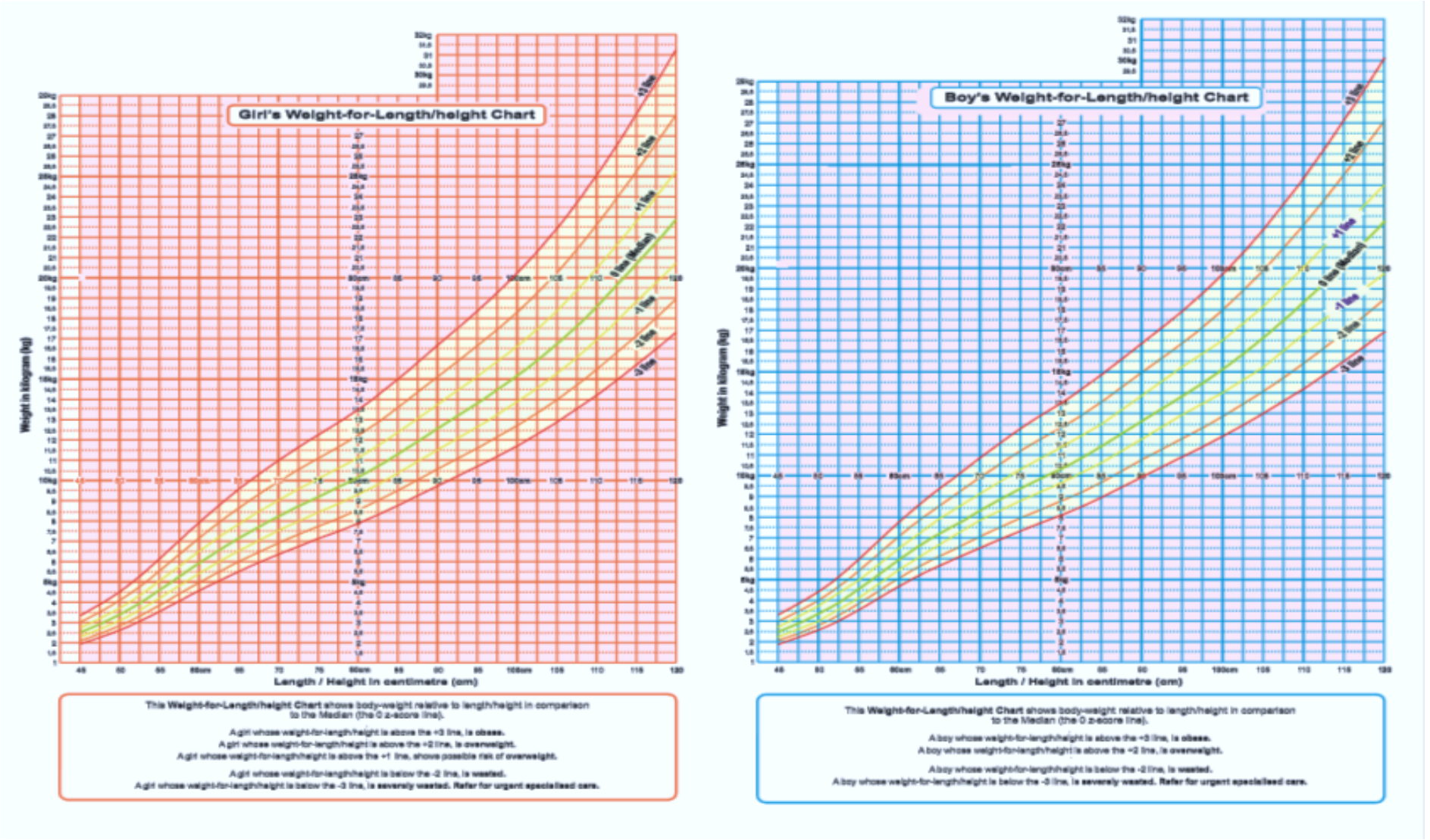
Mebendazole

ASSESS OTHER PROBLEMS:

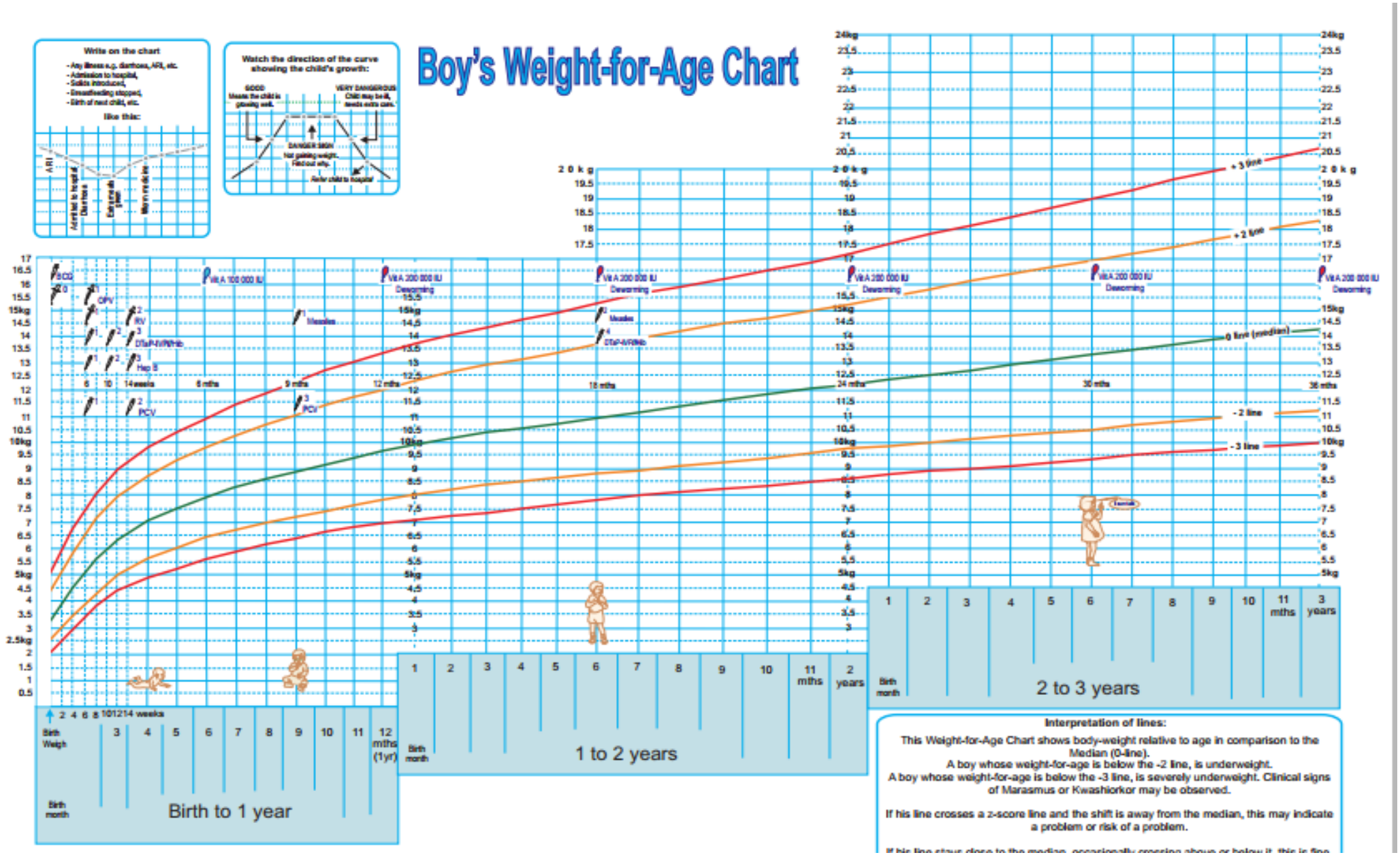
TREAT THE CHILD

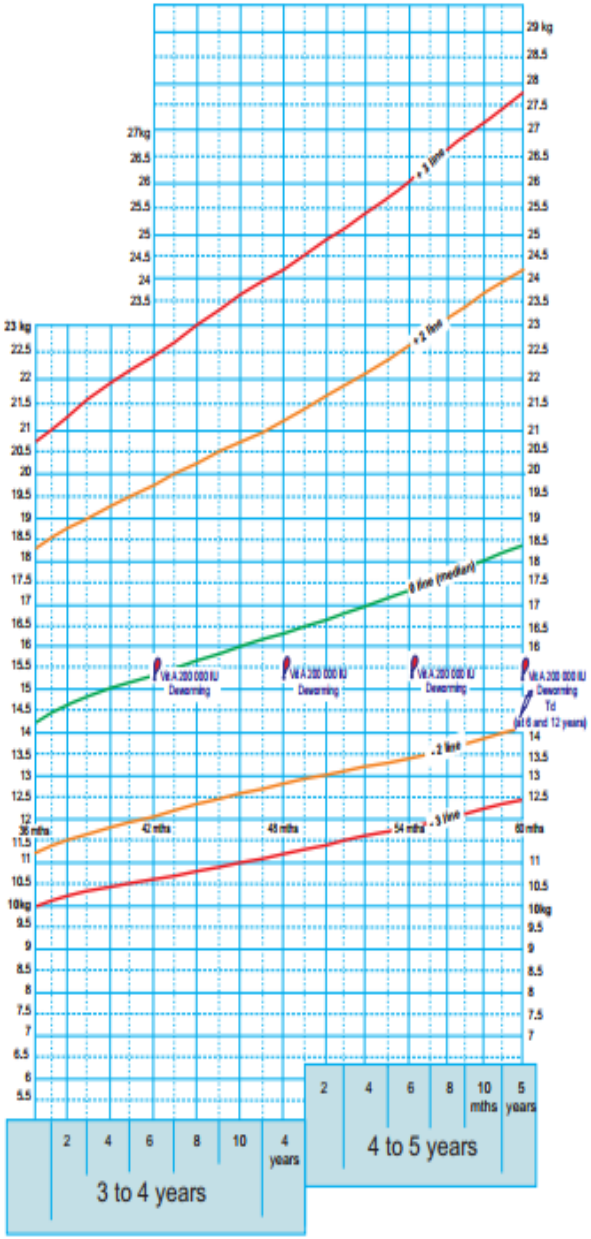
Refer any child who has a danger sign, even if no other severe

ADDENDUM D. Weight for height charts (girl and boy)

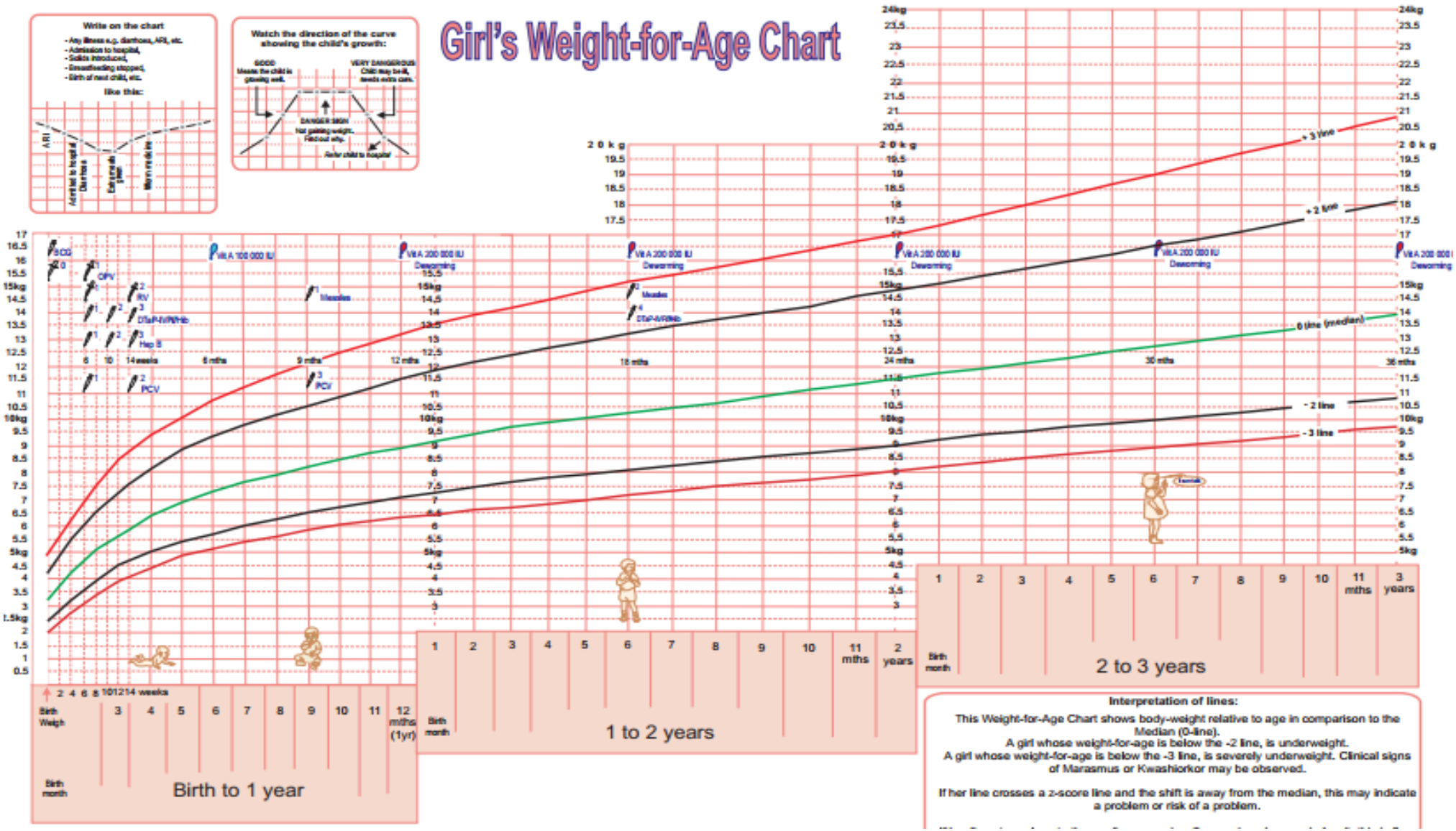


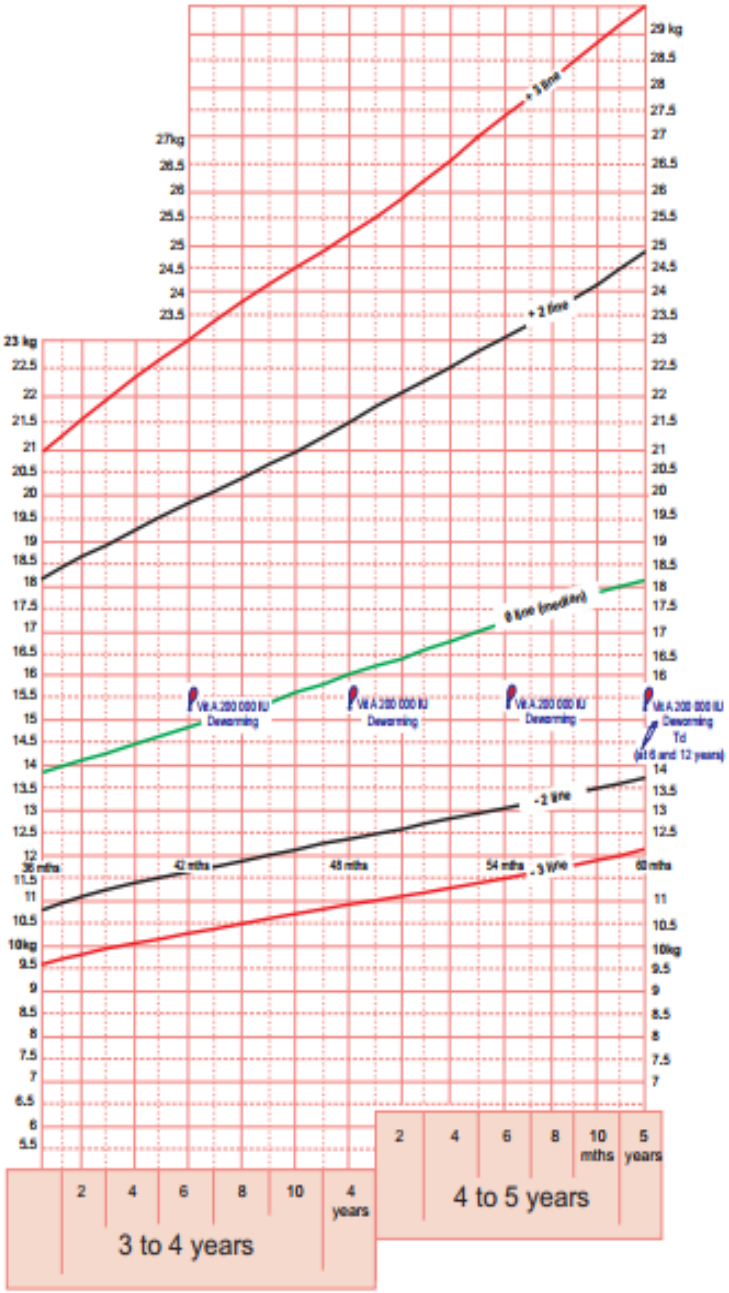
ADDENDUM E (Boy's chart)





ADDENDUM E (Girl's chart)





ADDENDUM F. Approval letter from HREC

Health Research Ethics Committee (HREC)

Approval Notice

New Application

05/07/2018 **Project ID :0752**

HREC Reference # S17/08/147

Updated Project Title:

Title: Management of Severe Acute Malnutrition in children aged 6-59 months by Professional Nurses in Primary Healthcare Facilities in Johannesburg Health District, South Africa: A retrospective analysis

Dear Mr Simon Shabangu

The **Response to Modifications** received on 20/06/2018 19:03 was reviewed by members of **Health Research Ethics**

Committee via **expedited** review procedures on 05/07/2018 and was approved. Please note the following information about your approved research protocol: Protocol Approval Period: **This project has approval for 12 months from the date of this letter.** Please remember to use your project **ID (0752)** on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After the Ethical Review

Translation of the informed consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC. Please note you can submit your progress report through the online ethics application process, available at Links Application Form Direct

Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/health research ethics) for guidance on how to submit a progress report.

The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see https://www.westerncape.gov.za/general-publication/health-research- approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website

https://applyethics.sun.ac.za/ProjectView/Index/752

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Mr Franklin Weber

HREC Coordinator

ADDENDUM G. Approval letter from the Gauteng department of health

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Joburg
a world class African city

JOHANNESBURG HEALTH DISTRICT

Enquiries: Dr EM Ohaju
Tel: 011 694 3888 Cell: 076 8831659
Email: Elizabeth.Ohaju@gauteng.gov.za

Hillbrow CHC: Administration Building
Cr Smith Str. & Klein Street
Private Bag X21, Johannesburg
South Africa, 2017

Faculty Of Health Sciences
Research Ethics Committee
Stellenbosch University
Stellenbosch, South Africa
sisha@webmail.co.za

DRC Ref: 2018-07-004

NHRD Ref no: GP_201807_036

Dear: MR Simon Vally Shabangu

Re: *Management of Severe Acute Malnutrition in children aged 6-59 months by Professional Nurses in Primary Health Care Facilities in Johannesburg Health District, South Africa: A retrospective analysis.*

Your application for Research Approval refers

The District Research Committee has reviewed your application. This letter serves as an in-principle approval to access the Districts Health facilities (mentioned below) for the above project subject to following conditions:

- The facility to be visited: **See the attachment**
- This facility will be visited from **17/09/2018 to 17/09/2019**
- The research can only commence after you submit an ethics clearance certificate from a recognized institution
- You will report to the Facility Manager before initiating the study.
- Participants' rights and confidentiality will be maintained all the time.

Region	Regional Health Manager	Contact No.	Cell phone
ABEF	Ms Matlala	011 440 1259	082 307 0267
D(LA)	Mabel Ngcobo	011 986 - 0164	082 467 9316
G	Tshidi Cebekulu	011 213 9602	071 678 5761

The following conditions must be observed:

- No resources (Financial, material and human resources) from the above facilities will be used for the study. Neither the District nor the facility will incur any additional cost for this study.

- The study will comply with **Publicly Financed Research and Development Act, 2008 (Act 51 of 2008) and its related Regulations**.
- You will submit a copy (electronic and hard copy) of your final report. In addition, you will submit a six-monthly progress report to the District Research Committee.
- Your supervisor and Stellenbosch University will ensure that these reports are being submitted timeously to the District Research Committee.
- The District must be acknowledged in all the reports/publications generated from the research and a copy of these reports/publications must be submitted to the District Research Committee.

We reserve our right to withdraw our approval, if you breach any of the conditions mentioned above.

Please feel free to contact us, if you have any further queries. On behalf of the District Research Committee, we would like to thank you for choosing our District to conduct such an important study.

Regards,

Dr EM Ohaju
Chairperson: District Research Committee
Johannesburg Health District
Date 17/09/2018

Mrs M Morewane
Chief Director
Johannesburg Health District
Date: 17/09/2018